AD-A152 347 ENVIRONMENTAL ASSESSMENT MAINTENANCE DREDGING OF VILLAGE CREEK BEAUFORT COUNTY SOUTH CAROLINA(U) CORPS OF ENGINEERS CHARLESTON SC CHARLESTON DISTRICT DEC 77 1/1

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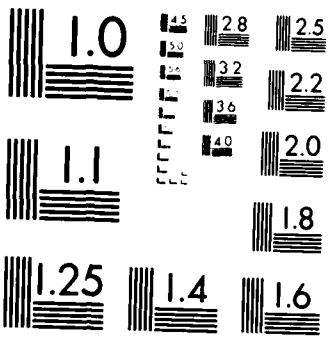

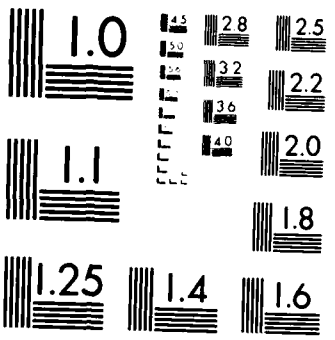

(2)

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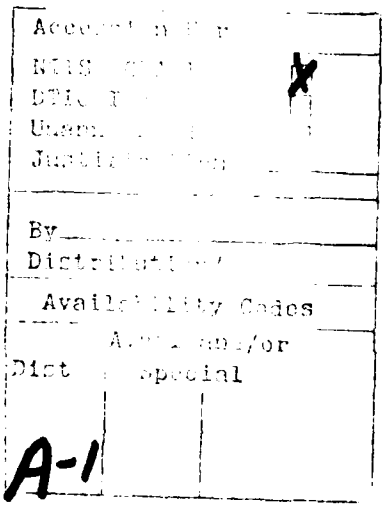

ENVIRONMENTAL ASSESSMENT
MAINTENANCE DREDGING OF VILLAGE CREEK
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Despite unconformities associated with the past tectonics of this region, the sedimentary deposits have been named in successively younger sequence: Tuscaloosa, Black Creek, PeeDee, Black Mingo, and Warley Hill Marl Formations; Santee, Castle Hayne, and Ocala Limestones. All of these strata are obscured by unconsolidated sands and clays of the surface terraces which were deposited during fluctuations in sea level since the early Miocene (Reference 5).

2.04 Soils. There are six major soil associations in Beaufort County. These associations are as follows:

Weston-Bladen-Eulonia Association. These soils are nearly level to gently sloping, moderately well to poorly drained soils. They are made up of loamy sand surface soils and sandy clay loam to clay subsoils.

Edisto-Weston-Stono Association. These are nearly level somewhat poorly to very poorly drained moderately deep soils. They are made up of loamy sand surface soils and sandy loam to sandy clay subsoils.

Kiawah-Wando-Seabrook Association. These are nearly level, somewhat poorly to well drained soils made of loamy fine sand surface soils and subsoils.

Ona-St. Johns Association. These are nearly level, poorly to somewhat poorly drained sands with organic stained layers or weakly cemented organic hardpans.

Tidal Marsh Association. This association is made up of firm to soft tidal marsh and is the major association adjacent to the project channel.

Swamp Association. This association is made up of nearly level very poorly drained soils on flood plains.

2.05 Water quality. The surface waters of the Village Creek project area, based on data available on Port Royal Sound and a lack of any major sources of pollution along the Morgan River, appear to be of excellent quality. As a result, waters of the Morgan River are designated as Class SA: waters suitable for shellfishing for market purposes, and suitable for uses requiring water of lesser quality. Chemical analysis of sediments and elutriate tests did not reveal the presence of any toxic or harmful substances. The results of these analyses are attached as Appendix A.

2.06 Biological resources. To facilitate a discussion of biological resources, the project area will be classified as follows: (1) Open water, (2) Marsh, (3) Oak-pine forest, (4) Agricultural land, and (5) Man-influenced land.

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2.07 Open water. The open water biotic community is exclusively salt water in the Village Creek project area. Plants in the open water community are restricted to phytoplankton and marine seaweeds which grow attached to various objects or may drift ashore with the tide. Enteromorpha, generally observed during the winter, occurs conspicuously in dense ribbons or thread-like growths on pier pilings, and sea lettuce, Ulva sp., may be abundant in the drift along shorelines.

2.08 The most important groups of animals in the open water communities are the planktonic organisms, benthic invertebrates, and fish. Food webs of this community demonstrate the basic interdependence of open water systems and surrounding terrestrial communities, particularly the marsh communities. For instance, many of the benthic organisms and fish at various stages of their life cycle depend directly on the marshes for food. Exchange of nutrients between aquatic; semi-aquatic, and terrestrial ecosystems, and distribution and diversity of species within them, are dependent on the energy provided by tidal action in estuaries.

2.09 Benthic invertebrates are detrital feeders and rely on the release of foods in the form of dead organic material (detritus) from marsh systems as their primary source of food. The population levels and species diversity of these forms are good indicators of the quality of estuarine ecosystems and, therefore, the presence (or absence) of pollution. Benthic phyla which may be represented are Mollusca, Arthropoda, Coelenterata, Echinodermata, Platyhelminthes, Nemertea, and Annelida. These phyla are found either as burrowers or attached to the substrate. Invertebrates of direct economic importance which are estuarine dependant are blue crabs, oysters, and shrimp.

2.10 Fish species utilizing open water areas as nursery areas are: black drum, sheepshead, Spanish mackeral, striped mullet, flounders, seatrout, weakfish, spot, and Atlantic croaker. Predator fish species include red drum, silver perch, ladyfish, and sea trout. All of these are economically important to both sport and commercial fishing industries.

2.11 Many birds, including the double-crested cormorant, the brown pelican, several species of gulls, and several species of ducks use the open water community for feeding and resting.

2.12 Marsh. The many acres of marsh in the Village Creek project area may be divided into low and high marsh communities.

2.13 The low marsh community is the largest in extent, least diverse in species composition, most uniform in plant height and community stratification, and the most productive of all the major communities in the area. The single species which typifies this community is smooth cordgrass. Occasionally, high marsh species will also be present in the low marsh community but such pioneers as glasswort, sea blite, or sea ox-eye never form extensive patches in the low

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marsh as they usually do in the high marsh community (Reference 6). Because of its tolerance to flooding and high saline conditions, smooth cordgrass thrives in an environment which is relatively free of competition from other species. Only in the zone where flooding is occasional or not a limiting factor at all is smooth cordgrass replaced as a result of competition by other species.

2.14 The high marsh is a narrow fringe community in the project area and is found along the upper elevational limits of the low marsh, along sandy embankments, and near the high water zone around the margin of wooded islands. It may consist entirely of grasses, succulent herbs and low shrubs. For example, a sandy berm may have a high marsh association of salt meadow cordgrass, sea ox-eye, and glasswort. In contrast, the high marsh might be composed predominantly of woody plants such as tamarisk, silverling, sea ox-eye, marsh elder, and wax myrtle.

2.15 The marsh communities support a large number and variety of animal life. Terrestrial animals such as raccoons, opossums, and mink visit this community while foraging for food. The low marsh also provides habitat upon which many shore and wading birds are dependent for food throughout the year. These birds include clapper rails, sandpipers, plovers, oystercatchers, ibis, egrets, and herons. Migratory game birds, such as ducks, are found feeding and loafing along and in the small creeks, embayments, and open water. Birds of prey, such as the osprey and marsh hawk are found along and over this community.

2.16 The marsh community is the interface between the upland communities and the open water. Detritus from these systems enters the marine environment, creating a highly productive area for larval and juvenile stages of aquatic fauna.

2.17 Oak-pine forest. The higher islands and sandy uplands which have not been cleared for agriculture are usually vegetated with a live oak-pine-cabbage palm forest. The oak-pine forest presents a tall, full appearance because of the conspicuous cabbage palms around the edges. The trees in this community are mostly evergreen species which form a dense canopy that reaches a height of about 40 feet. On Pine Island, located at the mouth of Village Creek, the dominant trees are live oak, cabbage palm, magnolia, loblolly pine, longleaf pine, red bay, wild olive, and wild black cherry. Understory species consist of small trees or tall shrubs such as wax myrtle, sassafras, yaupon, buckthorn, devil's-walking stick, chinaberry, winged sumac, and laurel cherry. Ground cover, although sparse, is floristically diverse. Thorny or spiny plants, such as Spanish bayonet, cactus, dewberry, blackberry, and catbrier, are frequently encountered under the low shrubs. Other notable small shrubs and herbs include coral beans, rattan vine, bedstraw, and American beauty berry. The epiphytes Spanish moss and resurrection fern are plentiful in the tops of the live oaks.

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The oak-pine forest found in this area is generally bordered by marsh or agricultural communities. The size of the oak-pine community and absence of dense understory and shrub cover limits the larger animals requiring extensive habitat area, such as white-tail deer. Predators such as bobcats, and foxes may be found within this area, but only as transients. The main inhabitants of this community are small mammals such as the gray squirrel, cotton rat, and mice, small birds, and several species of reptiles and amphibians.

Agricultural land. Truck farming and beef cattle production are the two main agricultural activities in the Village Creek area. Green beans, tomatoes, squash, cucumbers, Irish potatoes, corn, cabbage, peppers, and soybeans are produced in this area. With the planting season beginning about the last week in February, it is possible to grow more than one crop per season, although the greatest potential production is in the early spring. During the remainder of the year, after the fields are harvested, the fields are covered by a dense growth of weeds. Fields that are left fallow after harvest provide habitat for small mammals, birds, reptiles and amphibians, and hunting grounds for birds of prey. The cotton rat, house mouse, and opossum, for instance, are permanent residents, while the common nighthawk, marsh hawk and white-throated sparrow are temporary foragers.

Man-influenced land. At certain sites within the project area, biotic communities have been drastically altered by man's activities. There are four unconfined dredged material disposal areas situated in the low marsh on either side of Village Creek. These sites are covered by a veneer of thin mud and sand deposited earlier and the reestablishment of marsh plants on these sites has not been significant. Another man-influenced area occurs next to a small wooded island on the east side of Village Creek. An embankment was built adjacent to the island and the resulting impoundment of rain water has caused the area to become vegetated with brackish marsh vegetation, notably cattail and silverling. Highways, home sites, boat docks, and two seafood companies make up still another man-influenced area. Accommodation of these facilities has destroyed most of the biota associated with the original communities.

These man-influenced communities provide habitat for animals that adapt to man's presence such as the gray squirrel, flying squirrel, opossum, many birds, black rat, Norway rat, and house mouse. Reptiles and amphibians also utilize the relatively small habitats of both natural and introduced vegetation.

Endangered and threatened species. Endangered species (Reference 7) can be defined as those species in danger of extinction throughout all or a significant portion of their range. Their peril may result from one or more causes--loss of habitat or change in habitat, overexploitation, predation, competition or disease. Endangered and threatened species which occur or possibly occur in the project area are:

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		Status
Fish		
Shortnose sturgeon	Acipenser brevirostrum	Endangered
Reptiles and Amphibians		
American alligator	Alligator mississipiensis	Threatened
Birds		
Eastern brown pelican	Pelecanus occidentalis carolinensis	Endangered
Southern bald eagle	Haliaeetus l. leucocephalus	"
Peregrine falcon	Falco peregrinus	"
Bachman's warbler	Vermivora bachmanii	"
Kirtland's warbler	Dendroica kirtlandii	"
Eskimo curlew	Numenius borealis	"
Red-cockaded woodpecker	Dendrocopus borealis	"

The shortnose sturgeon was a resident of Atlantic seaboard rivers from New Brunswick to Florida, however, most recent records are from the Altamaha River. The alligator is commonly observed in freshwater rivers in Beaufort County. The brown pelican is a commonly observed resident of coastal South Carolina. The bald eagle, a permanent resident of the state, has been sighted near Victoria Bluff (Reference 8). The peregrine falcon, Kirtland's warbler and the Eskimo curlew are transient species. According to the U. S. Fish and Wildlife Service, Bachman's warbler, one of the rarest of our small birds, has been observed in the I'on Swamp near Charleston. The red-cockaded woodpecker is a resident of the old-age pine woodlands.

2.23 Historical and archeological sites. The latest edition of the National Register of Historic Places lists 21 sites in Beaufort County. None of these sites are located within the area of project influence.

2.24 Land use. Of the approximately 575 square miles which make up Beaufort County, almost 100 square miles are made up of tidelands. Approximately 150 square miles of Beaufort County are classified as farmlands, but only about 30 square miles are utilized. Cattle grazing constitutes a major use of this utilized land and the remainder is used for raising tomatoes, cucumbers, and other crops on a commercial scale. Some 30 square miles are classified as urbanized land. These lands include the cities of Beaufort and Port Royal, the military centers of Parris Island and Laurel Bay Marine Air Station, and the resort-retirement developments on Hilton Head and Fripp Islands.

2.25 Economic Development.

2.26 Employment. The civilian labor force in Beaufort County in 1977 amounted to 17,200 persons, as compared with 12,050

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... enough organic materials to significantly
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...ation. Research conducted in similar areas in-
... of dredging on the primary production of phy-
...ally inhibitory due to increased turbidity. Re-
... place shortly after dredging is completed.

... Research conducted on the survival of
... ...s may be reduced during actual
... operations, but the area affected would be com-
... effects would decrease rapidly with distance from
...

... invertebrates. Benthic invertebrate communities,
... total lack of stability would likely be adversely
... damage by the proposed project. As discussed
... project channels would be accomplished by
... Some benthic invertebrates in the path of
... to be destroyed. This gross effect has been well
... to occur to some extent during the main-
... ...ed channel.

... concentrations of benthic invertebrates in
... or in the shallower areas in and around the
... areas. Although some minor
... areas, the area of greatest impact would
... of the dredge. Although the short-term
... may be locally severe, the overall
... insignificant as repopulation from adjacent
... after dredging is completed.

... available data indicate that fish populations, un-
...brates which are relatively immobile and may undergo
...ions that may be locally severe, are less likely to be
... by dredging operations. In some areas, dredging
... to be beneficial to certain species of fish, espe-
... on the larger benthic organisms. As a dredge
... channel, benthic animals which would normally be
... are dislodged and become susceptible to pre-
... availability of food quite often results in higher
...ions of fishes near the dredge. A similar sit-
... adjacent to disposal areas.

... previously, shoal materials are mainly composed
... removal of these materials could create short-
... which could become locally severe. Fish
... the highest probability of being affected are
... ...ion, herring, and shad) and juvenile
... abundance of these species in the area

[illegible] (Reference 8). The rate of unemployment in 1974 was 5.3 percent [illegible] the rate of unemployment in 1974 was over one-half a percentage [illegible] that for the State. Less than seven percent of the [illegible] employment in Beaufort County was in manufacturing, [illegible] than 23 percent of the nonagricultural employment was in [illegible].

Income. Per capita income in Beaufort County in 1974 was [illegible] to $3,618 for the State of South Carolina and the U. S. [illegible] (Reference 9).

Industry. The principal industry in the immediate proj- [illegible] commercial fishing. Because of the proximity of trawling [illegible] the south of St. Helena Sound, a fleet of 35-40 shrimp [illegible] of Village Creek. These boats land their catch at [illegible] located adjacent to the creek.

The Probable Impact of the Proposed Action on the Environment

General. Material dredged from the creek in the past was [illegible] disposal areas located on former low marsh. The [illegible] disposal areas has not yet been determined but the [illegible] any of the three most likely areas are [illegible] following parts of this section. These three areas are: [illegible] on islands, diking and re-use of disposal areas in [illegible], and open water disposal in a deepwater portion of [illegible]. The major adverse effects expected to result from [illegible] any one of these disposal alternatives relate to effects [illegible] quality and on the ecosystems in the disposal areas, channel [illegible] other areas which might be disturbed by maintenance activ-

Dredging.

Water quality. Dredging would not result in any long- [illegible] significant adverse impacts on the water quality of the Village [illegible] and estuarine system. As is characteristic of any [illegible] operation, water turbidity in the vicinity of the [illegible] a result of the mechanical action of the dredge [illegible] would also increase in the vicinity of selected [illegible] analyses (see Appendix A) indicate that most [illegible] silt and fine sand. As a result, short-term [illegible] be locally severe. Long-term effects, [illegible] nt and should not adversely affect the [illegible] and estuarine system. As discussed in [illegible] of sediments in shoal areas did not [illegible] toxic or harmful substances in amounts that [illegible] life. However, the disturbance of any [illegible] anaerobic decomposition could cause a [illegible] oxygen levels in the immediate vicinity

[illegible] practical to attempt [illegible] these species. In addition, [illegible] fishes could be destroyed [illegible] of the dredge cutterhead. However, [illegible] practices in other areas indicate [illegible] from the proposed dredging would be of [illegible] and would not significantly affect the fish [illegible] St. Helena Sound estuarine system. If [illegible] conducted during periods of low biological [illegible] species.

[illegible] Open water disposal in Morgan River [illegible] the most desirable disposal alternatives. It [illegible] associated with the diking of productive [illegible] long-term or significant adverse impact [illegible] water system.

[illegible] effects expected to result from open water disposal [illegible] on water quality and ecosystems in the disposal [illegible] be confined to the immediate vicinity of the [illegible] materials are released into the water column. [illegible] dredged materials, these increases in turbidity [illegible] short-term adverse affect on water [illegible] These effects would be similar to those presented in Sections 3.04, 3.05, 3.06, and 3.08 [illegible] dredged material to be removed, it is unlikely that [illegible] significant enough to adversely affect shellfish [illegible] River.

[illegible] benthic invertebrates could be smothered as dredged [illegible] the bottom. Although losses could be locally severe, [illegible] position should be suitable for recolonization [illegible] from adjacent areas. As a result, open water disposal [illegible] in any long-term or significant adverse impacts [illegible] population in the Morgan River or St. Helena Sound ecosystems.

[illegible] existing marsh disposal site. Because of the high [illegible] marshes, it is considered unlikely that new disposal [illegible] would be acquired by the project sponsor. [illegible] consideration is being given to diking the existing marsh [illegible] this area has been severely altered by previous [illegible] impacts associated with its use would be of a much [illegible] than those associated with disposal in unaltered marsh.

[illegible] as disposal areas become progressively filled [illegible] dredged elevation exceeds the height reached by spring [illegible] the marsh surface is no longer subject to tidal overflow [illegible] effluent of dredged material, the disposal area [illegible] characteristics of an upland area. Plants are

... of the high sand and silt content of shoal ma-
... enough organic materials to significantly
...

...ation. Research conducted in similar areas in-
... of dredging on the primary production of phy-
...ally inhibitory due to increased turbidity. Re-
... place shortly after dredging is completed.

... Research conducted on the survival of
... ...s may be reduced during actual
... operations, but the area affected would be com-
... effects would decrease rapidly with distance from
...

... invertebrates. Benthic invertebrate communities,
... total lack of stability would likely be adversely
... damage by the proposed project. As discussed
... project channels would be accomplished by
... Some benthic invertebrates in the path of
... to be destroyed. This gross effect has been well
... to occur to some extent during the main-
... ...ed channel.

... concentrations of benthic invertebrates in
... or in the shallower areas in and around the
... areas. Although some minor
... areas, the area of greatest impact would
... of the dredge. Although the short-term
... may be locally severe, the overall
... insignificant as repopulation from adjacent
... after dredging is completed.

... available data indicate that fish populations, un-
...brates which are relatively immobile and may undergo
...ions that may be locally severe, are less likely to be
... by dredging operations. In some areas, dredging
... to be beneficial to certain species of fish, espe-
... on the larger benthic organisms. As a dredge
... channel, benthic animals which would normally be
... are dislodged and become susceptible to pre-
... availability of food quite often results in higher
...ions of fishes near the dredge. A similar sit-
... adjacent to disposal areas.

... previously, shoal materials are mainly composed
... removal of these materials could create short-
... which could become locally severe. Fish
... the highest probability of being affected are
... ...ion, herring, and shad) and juvenile
... abundance of these species in the area

as smooth cordgrass, black needle rush, and big cordgrass are eventually replaced by other grasses, poke berry, silverling, marsh elder, and wax myrtle. This conversion to an upland environment represents a permanent loss of the marsh involved in the disposal operation.

3.15 The loss of marsh also represents a reduction in the habitat available to marine forms and wildlife. Some species of fish, such as the speckled trout, spend their entire lives in estuaries. Others, including white and brown shrimp, blue crabs, croakers, spot, and red drum spend part of their juvenile life in marshes and adjacent water areas. Birds and mammals frequenting the marsh would be disturbed or displaced during disposal operations. As an area is converted to upland, mammals such as the raccoon, opossum, marsh rabbit and various rodents would continue to use the area although its habitat value may be reduced. After scrubs and trees become established, birds such as sparrows, red-winged blackbirds, grackles, and marsh hawks and small mammals would return.

3.16 Use disposal areas on uplands. Since the rationale for preservation of individual tracts of marshland does not apply to upland areas such as woodlands and agricultural lands, use of these lands is considered a viable alternative.

3.17 Woodlands are one of the most common environmental types in the Gulf coast area and are considered likely areas to be provided by the project sponsor. Prior to use of any wooded tract, the owner would probably remove merchantable timber. In any event, dense stands would be removed to permit a more even distribution throughout the disposal area of the hydraulically dredged material. Any trees not removed and all understory plants would be killed when their roots become covered to a sufficient depth. Vegetative regrowth would probably consist of poke berry, and other herbs and shrubs such as silverling and wax myrtle, and trees of most of the same species growing prior to disposal. Practically all significant animal life except for some small birds and mammals would be displaced during and shortly after use of a wooded disposal area. As vegetative regrowth occurs, foraging by species displaced during the preparation and clearing and subsequent use of the area would increase. Plant and animal life would fluctuate from a low during and shortly after deposition to a high just before each disposal operation. When capacity has been reached, a reversion to a wooded state by sweetgum, pines, hackberry, oaks, and other upland species will occur unless man's activities intervene through use of the area for cultivation or residential or other development.

3.18 Agricultural lands also appear to be likely areas to be provided by the project sponsor for disposal of dredged material. Agricultural lands are one of the lease common environmental types, but some of the basic restrictions operating against the selection of marsh and woodlands do not apply. The impact on wildlife of using cultivated land for the disposal of dredged material depends on the length of time since the land may have been cultivated. Recently cultivated land usually has very little year round utility for wildlife because of the

[illegible] practical to attempt [illegible] these species. In addition, [illegible] fishes could be destroyed [illegible] of the dredge cutterhead. However, [illegible] practices in other areas indicate [illegible] from the proposed dredging would be of [illegible] and would not significantly affect the fish [illegible] St. Helena Sound estuarine system. If [illegible] conducted during periods of low biological [illegible] species.

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common practice of clean farming, and the use of such an area would have little impact on wildlife. Fields that are left fallow for some time provide habitat for a number of small animals. Most of these would be

common practice of clean farming, and the use of such an area would have little impact on wildlife. Fields that are left fallow for some time provide habitat for a number of small animals. Most of these would be displaced during and shortly after the area dries. Poke berry and other

4.02 In addition, some benthic organisms may be destroyed by the dredge cutterhead or smothered in any open water disposal areas. Wildlife species inhabiting upland disposal sites would be displaced by the deposition of dredged materials. Although the grasses on upland disposal areas would be relatively unaffected by the dredged material, some of the woody vegetation could be killed. Regrowth usually begins soon after dredging is completed.

5.0 Alternatives to the Proposed Action

5.01 In addition to the disposal alternatives discussed in Section 3.0, consideration must also be given to discontinuing maintenance dredging of Village Creek. If this no action alternative were adopted, siltation would continue until the creek would become too shallow to accommodate the shrimp boats which now utilize it. Although this alternative would avoid the adverse affects associated with dredging and disposal operations, it would forego the economic benefits derived from the shrimp boats which are essential to the local economy. This alternative, therefore, appears unacceptable since the project's benefits are believed to greatly outweigh the adverse environmental impacts that would result from continued maintenance of the project.

of the county's mosquito control program if it is determined that a disposal area provides a mosquito breeding site. The Federal cost would be proportionate to the contribution of the disposal area to the mosquito problem. The most commonly used insecticide is Flit M.L.O., an oil larvicide which dissipates quickly and has no effect on other aquatic life. However, since Flit has no residual effect, a control program utilizing this larvicide requires frequent inspection and respraying.

3.23 Archeological and historical sites. The continued maintenance of Village Creek should have no impact on archeological or historical resources. The National Register of Historic Places lists no Register properties which would be adversely affected by the proposed work. In the event that the project is modified or a new upland disposal area is provided by the local sponsor, the new areas would be surveyed and the State Historic Preservation Officer would be contacted.

3.24 Aesthetics. Aside from the physical presence of the dredge and floating pipeline that will be in the creek during maintenance dredging, there will be little or no effect on aesthetics. Upland disposal sites might be aesthetically displeasing to users of adjacent land.

3.25 Air quality. There will be a very minor increase in air pollution as a result of operation of the dredge; however, the effects will be temporary as well as insignificant and probably not measurable.

3.26 Noise. Noise generated by the dredge while it is working at the upper end of the project may be somewhat displeasing but will be of relatively short duration. The remaining portion of the operation should not raise noise levels appreciably.

3.27 Economic impact. The continued maintenance of Village Creek would continue to have a favorable economic impact on the area. The shrimp boats now supplying the packing houses would continue to use the area.

4.0 Any Probable Adverse Environmental Effects Which Cannot Be Avoided

4.01 A detailed discussion of all environmental impacts expected to result from the project is contained in Section 3.0. Some of these impacts are considered unfavorable, but cannot be avoided by any practical means within the authority and scope of the proposed project. The principal adverse impacts relate to temporary changes in water quality and its effect on the creek and disposal area ecosystems. These effects include: increased turbidities and siltation in the vicinity of the dredge and disposal areas and a possible reduction in dissolved oxygen levels as a result of the dredge disturbing organic materials undergoing anaerobic decomposition.

REFERENCES

[illegible] Department of Commerce. 197[illegible]. Tide tables and low water [illegible], East Coast of North and South America including [illegible] 288pp.

[illegible] 197[illegible]. Local climatological data, [illegible], Charleston, South Carolina.

[illegible] The Coastal Plain of South Carolina, [illegible] Surveys. Bull. [illegible].

[illegible] and Counties, Municipal [illegible], South Carolina, Columbia. 452pp.

[illegible] Johnson, Jr. 19[illegible]. Tertiary [illegible] South Carolina. Palaeogeography, Palaeo[illegible] 5:105-126.

[illegible] S. E. Ahles, and G. R. Bell. 19[illegible]. Mean [illegible] Shore of the Carolinas. University of North Carolina [illegible] Hill. 11.

[illegible] of the Interior. 1977. Endangered and threatened [illegible] Parts. Federal Register, Vol. 42, No. 135.

[illegible] Resources Commission. 1972. Port Royal Sound Environmental [illegible] Columbia, S.C. 555pp.

[illegible] Coast Security Commission, South Carolina's [illegible] Industry, Research and Statistics Section, Columbia.

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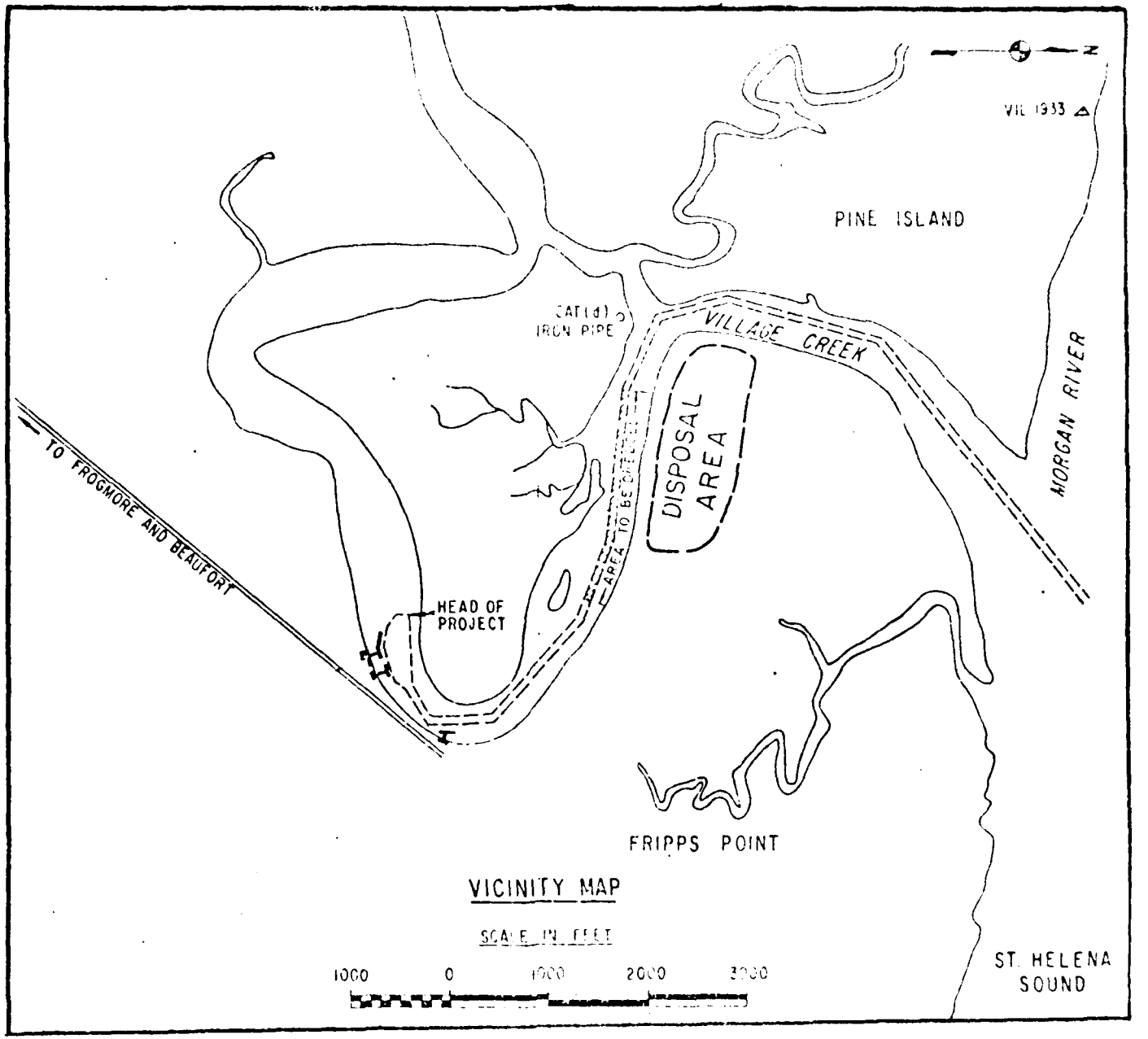
PLATE 1


VIL 1933
PINE ISLAND
CAT (d) IRON PIPE
VILLAGE CREEK
MORGAN RIVER
DISPOSAL AREA
TO FROGMORE AND BEAUFORT
HEAD OF PROJECT
FRIPPS POINT
ST. HELENA SOUND
VICINITY MAP
SCALE IN FEET
1000 0 1000 2000 3000

REFERENCES

[illegible] Department of Commerce. 197[illegible]. Tide tables and low water [illegible], East Coast of North and South America including [illegible] 288pp.

[illegible] 197[illegible]. Local climatological data, [illegible], Charleston, South Carolina.

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[illegible] Resources Commission. 1972. Port Royal Sound Environmental [illegible] Columbia, S.C. 555pp.

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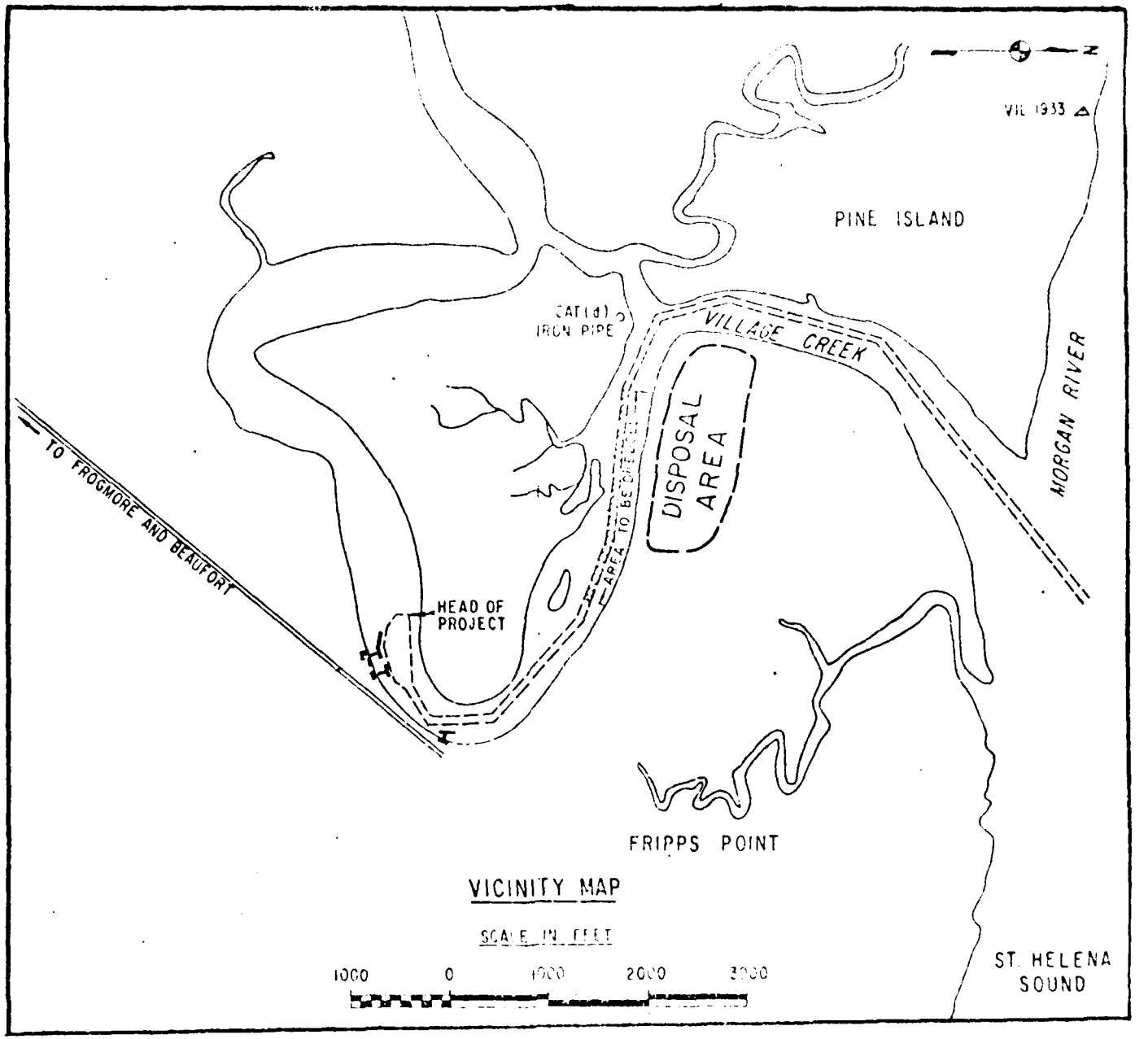
APPENDIX A

Standard Elutriate Tests and Sediment Analysis

PLATE 1


VIL 1933
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MORGAN RIVER
DISPOSAL AREA
TO FROGMORE AND BEAUFORT
HEAD OF PROJECT
FRIPPS POINT
ST. HELENA SOUND
VICINITY MAP
SCALE IN FEET
1000 0 1000 2000 3000

U. S. ARMY ENGINEER DIVISION LABORATORY, SOUTH ATLANTIC
CORPS OF ENGINEERS
MARIETTA, GEORGIA

DISTRICT: Charleston
PROJECT: Village Creek
CONTRACT NO.: ---

GENERAL TEST REPORT
(STANDARD ELUTRIATE TEST)

DATE REPORTED: 1 April 1977
WORK ORDER NO.: 0520
DESCRIPTION: Sediment and Water
REQN. NO.: SACEC-77-28
SOURCE:
BASE UNIT COST: --
FOR USE AS:
DATE SAMPLE RECEIVED: 3-17-77
TESTED FOR: Chemical Analysis (See Below)
LAB NO.: See Below

☐ MEETS SPECIFICATIONS ☐ FAILS SPECIFICATIONS (See below)

Lab. No.		3E389*	3E390*
Field Sample No.		Receiving Water Disposal Site	Elutriate VCE-1
Total Organic Carbon	mg/l	4	11
Nitrogen, Ammonia	"	0.18	0.96
Nitrogen, Kjeldahl	"	0.38	2.56
Oil and Grease	"	<1.0	<1.0
Total Phosphorus as P	"	0.035	0.090
Ortho Phosphorus as P	"	0.013	0.013
Lead	ug/l	5.0	4.5
Zinc	"	10.	12.
Mercury	"	<0.5	<0.5
Iron	"	26	26
Cadmium	"	<0.25	1.0
Arsenic	"	<5	<5
Chromium	"	<5	<5
Nickel	"	4.0	4.5
Copper	"	1.4	1.3
Beryllium	"	<0.25	<0.25
Selenium	"	<5	<5

REMARKS:
*Gradation curves reported on ENG Form 2087.
*Chemical Analysis of Sedimentation, SAD Form 158R.

REPORTED BY: PHONE WIRE
DATE
TESTED BY: KB, JN, DW
CHECKED BY: DW
SAMPLED BY

SAD FORM 158-R
10 OCT 73
Previous editions of this form are obsolete.

APPENDIX A

Standard Elutriate Tests and Sediment Analysis

U. S. ARMY ENGINEER DIVISION LABORATORY, SOUTH ATLANTIC
CORPS OF ENGINEERS
MARIETTA, GEORGIA

DISTRICT: Charleston
PROJECT: Village Creek
CONTRACT NO.: ---

GENERAL TEST REPORT
(SEDIMENT)

DATE REPORTED: 1 April 1977
WORK ORDER NO.: 0520

DESCRIPTION: Sediment Samples
REQN. NO.: SACEC-77-28

SOURCE:
BASE UNIT COST: ---

FOR USE AS:
DATE SAMPLE RECEIVED: 3-17-77

TESTED FOR: Chemical Analysis (see below)
LAB NO.: See Below

☐ MEETS SPECIFICATIONS ☐ FAILS SPECIFICATIONS (See below)

	Percent by Weight (Dry Basis	
Lab. No.	3W391*	3S392*
Field Sample No.	VC-1	VS-2
Volatile Solids (Max 6.0)	7.44	8.93
T. V. S. Formula EC	7.68	9.17
Total Organic Carbon	1.80	2.55
C. O. D., (Max 5.0)	6.49	8.01
Nitrogen, Kjeldahl (Max 0.10)	0.167	0.208
Oil and Grease (Max 0.15)	0.043	0.073
Lead (Max 0.005)	0.0016	0.0017
Zinc (Max 0.005)	0.0034	0.0036
Mercury (Max 0.0001)	< 0.00002	< 0.00002
Total Phosphorus as PO_4	0.44	0.36
Iron	1.6	1.7
Cadmium	< 0.00005	0.00005
Arsenic	0.00050	0.00040
Chromium	0.0024	0.0023
Nickel	0.0013	0.0013
Copper	0.0007	0.0007
Beryllium	0.00008	0.00010
Selenium	< 0.00001	< 0.00001
Vanadium	0.0028	0.0028

REMARKS:

*Elutriate Test reported on SAD Form 158R.
*Gradation Curves reported on ENG Form 2087.

REPORTED BY: PHONE WIRE
DATE

TESTED BY: JL, JN, DW
CHECKED BY: DW
SAMPLED BY:

SAD FORM 158-R
10 OCT 73

Previous editions of this form are obsolete.

U. S. ARMY ENGINEER DIVISION LABORATORY, SOUTH ATLANTIC
CORPS OF ENGINEERS
MARIETTA, GEORGIA

DISTRICT: Charleston
PROJECT: Village Creek
CONTRACT NO.: ---

GENERAL TEST REPORT
(STANDARD ELUTRIATE TEST)

DATE REPORTED: 1 April 1977
WORK ORDER NO.: 0520
DESCRIPTION: Sediment and Water
REQN. NO.: SACEC-77-28
SOURCE:
BASE UNIT COST: --
FOR USE AS:
DATE SAMPLE RECEIVED: 3-17-77
TESTED FOR: Chemical Analysis (See Below)
LAB NO.: See Below

☐ MEETS SPECIFICATIONS ☐ FAILS SPECIFICATIONS (See below)

Lab. No.		3E389*	3E390*
Field Sample No.		Receiving Water Disposal Site	Elutriate VCE-1
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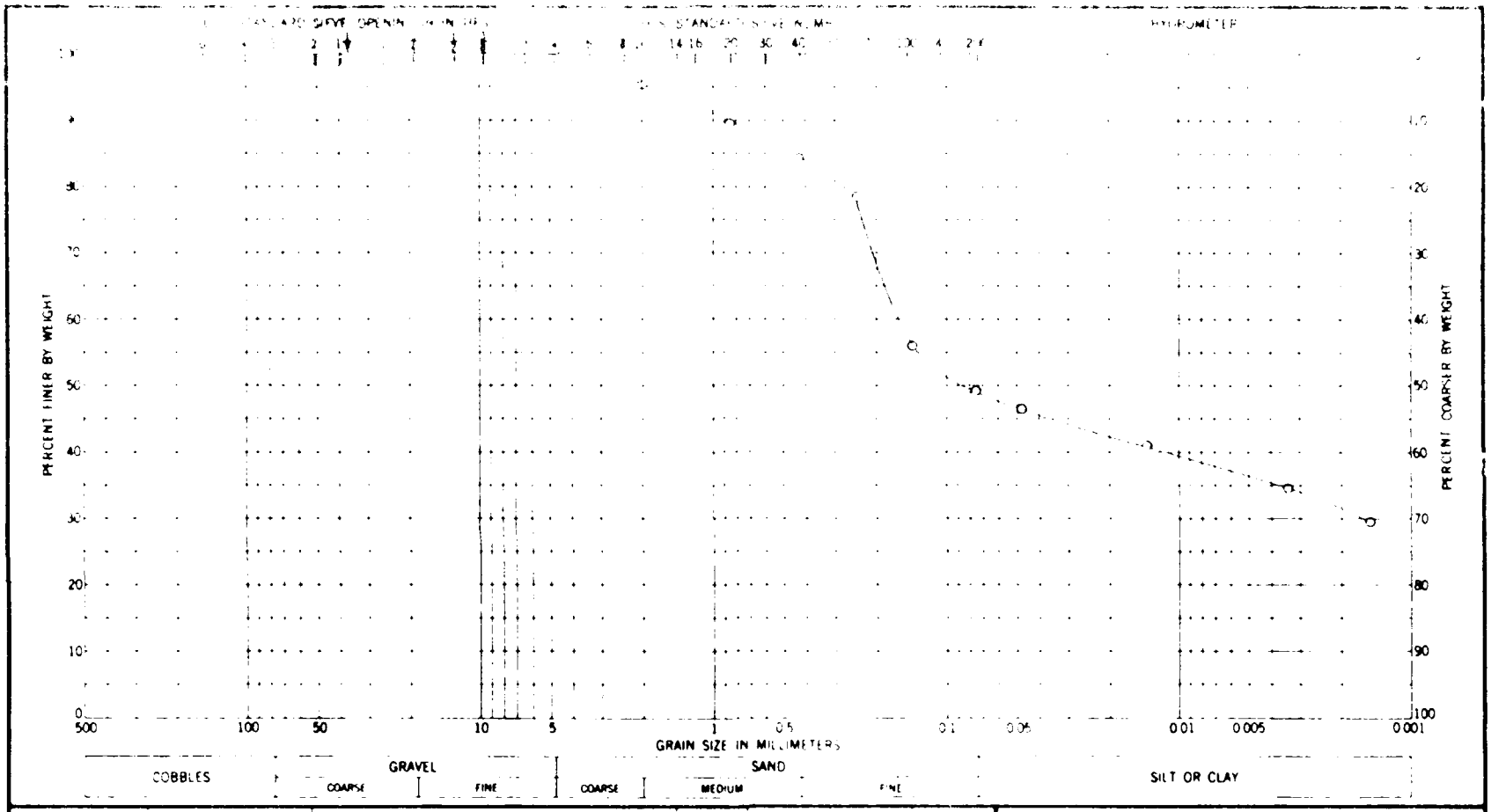
Nitrogen, Kjeldahl	"	0.38	2.56
Oil and Grease	"	<1.0	<1.0
Total Phosphorus as P	"	0.035	0.090
Ortho Phosphorus as P	"	0.013	0.013
Lead	ug/l	5.0	4.5
Zinc	"	10.	12.
Mercury	"	<0.5	<0.5
Iron	"	26	26
Cadmium	"	<0.25	1.0
Arsenic	"	<5	<5
Chromium	"	<5	<5
Nickel	"	4.0	4.5
Copper	"	1.4	1.3
Beryllium	"	<0.25	<0.25
Selenium	"	<5	<5

REMARKS:
*Gradation curves reported on ENG Form 2087.
*Chemical Analysis of Sedimentation, SAD Form 158R.

REPORTED BY: PHONE WIRE
DATE
TESTED BY: KB, JN, DW
CHECKED BY: DW
SAMPLED BY

SAD FORM 158-R
10 OCT 73
Previous editions of this form are obsolete.

DEPARTMENT OF THE ARMY SOUTH ATLANTIC DIVISION, CORPS OF ENGINEERS



Sample No.	Elev. or Depth	Visual Classification	w %	LL	PL	P
--	--	Dk.gray silty sand, high LL (SM-H) w/a little gravel size & coarse-med.sand size shell frag, with a trace of organic fines SpG = 2.65	69.8	--	--	--

Project: CHARLESTON DISTRICT, Village Creek
Lab. No. 35-391*
Area
Boring No. VC-1
Date: 1 April 1977

GRADATION CURVES

ENG FORM 2087

*Elutriate Test reported on SAD Form [illegible]
*Chemical Analysis of Sediment reported on [illegible]

U. S. ARMY ENGINEER DIVISION LABORATORY, SOUTH ATLANTIC
CORPS OF ENGINEERS
MARIETTA, GEORGIA

DISTRICT: Charleston
PROJECT: Village Creek
CONTRACT NO.: ---

GENERAL TEST REPORT
(SEDIMENT)

DATE REPORTED: 1 April 1977
WORK ORDER NO.: 0520

DESCRIPTION: Sediment Samples
REQN. NO.: SACEC-77-28

SOURCE:
BASE UNIT COST: ---

FOR USE AS:
DATE SAMPLE RECEIVED: 3-17-77

TESTED FOR: Chemical Analysis (see below)
LAB NO.: See Below

☐ MEETS SPECIFICATIONS ☐ FAILS SPECIFICATIONS (See below)

	Percent by Weight (Dry Basis	
Lab. No.	3W391*	3S392*
Field Sample No.	VC-1	VS-2
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Nickel	0.0013	0.0013
Copper	0.0007	0.0007
Beryllium	0.00008	0.00010
Selenium	< 0.00001	< 0.00001
Vanadium	0.0028	0.0028

REMARKS:

*Elutriate Test reported on SAD Form 158R.
*Gradation Curves reported on ENG Form 2087.

REPORTED BY: PHONE WIRE
DATE

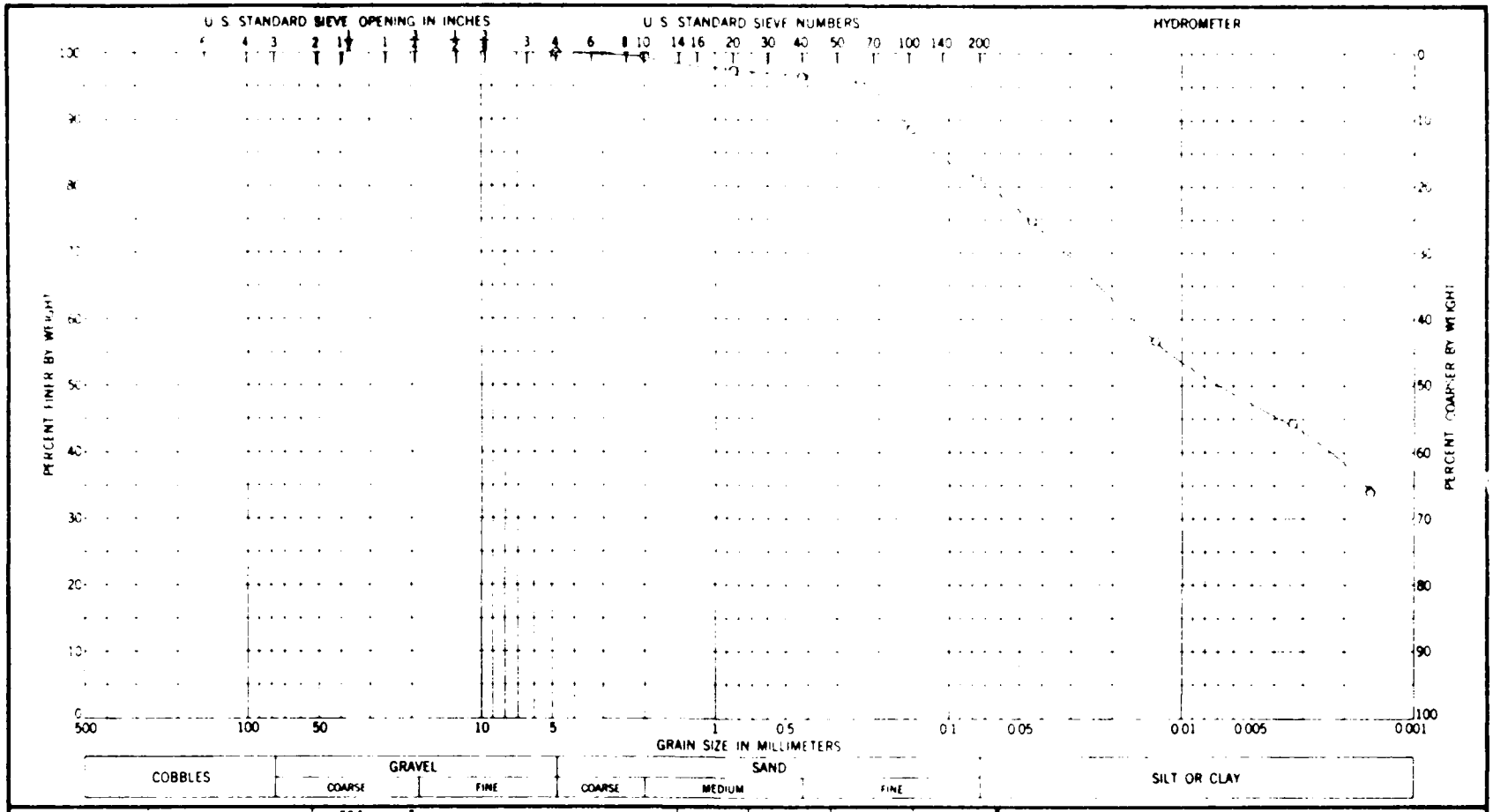
TESTED BY: JL, JN, DW
CHECKED BY: DW
SAMPLED BY:

SAD FORM 158-R
10 OCT 73

Previous editions of this form are obsolete.

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA 30061

WORK ORDER NO. 0520
Re. No. SACEC-77-28



Sample No	Elev or Depth	Visual Classification	Nat w %	LL	PL	PI
--	--	Dk.gray clayey inorg.silt, high LL (MH) w/a trace of organic fines & shell frag. SpG = 2.62	118.8	--	--	--

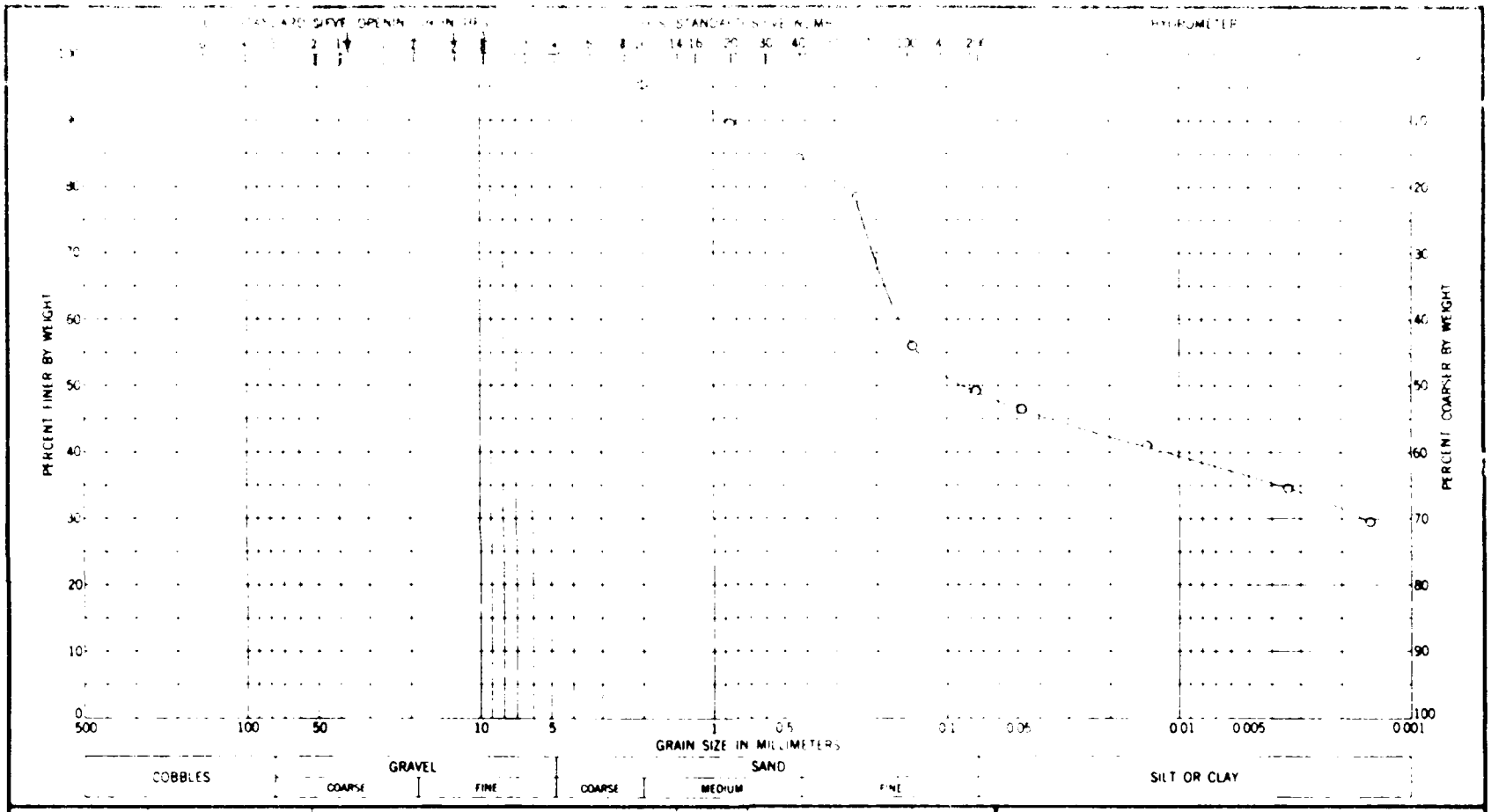
GRADATION CURVES

Proje CHARLESTON DISTRICT, Village Creek
Lab. No. 3S-392*
Area
Boring No VC-2
Date 1 April 1977

ENG FORM 2087

*Elutriate Test reported on SAD Form 158R.
*Chemical Analysis of Sediment reported on SAD Form 158R.

DEPARTMENT OF THE ARMY SOUTH ATLANTIC DIVISION, CORPS OF ENGINEERS



Sample No.	Elev. or Depth	Visual Classification	w %	LL	PL	P
--	--	Dk.gray silty sand, high LL (SM-H) w/a little gravel size & coarse-med.sand size shell frag, with a trace of organic fines SpG = 2.65	69.8	--	--	--

Project: CHARLESTON DISTRICT, Village Creek
Lab. No. 35-391*
Area
Boring No. VC-1
Date: 1 April 1977

GRADATION CURVES

ENG FORM 2087

*Elutriate Test reported on SAD Form [illegible]
*Chemical Analysis of Sediment reported on [illegible]

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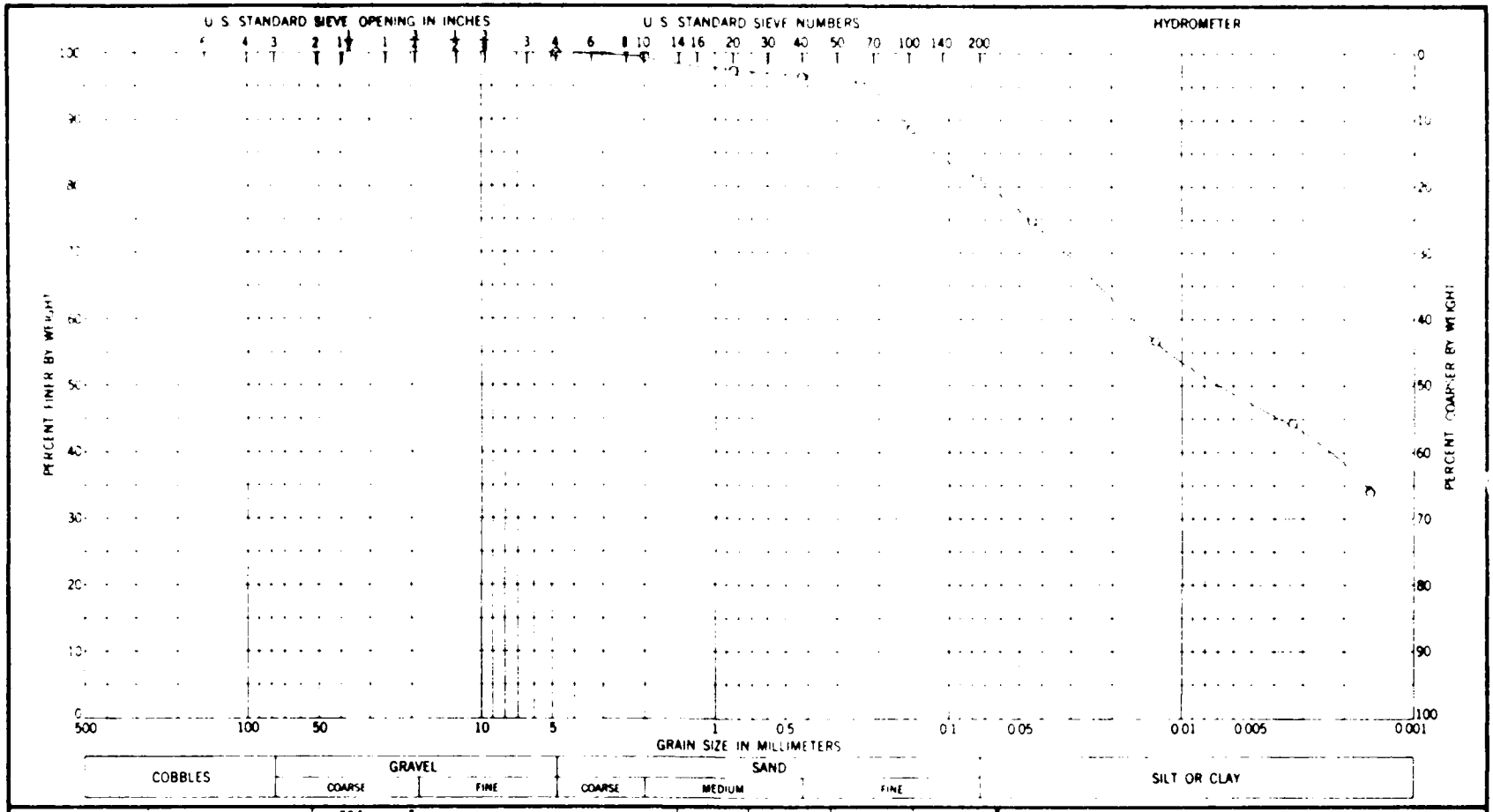
DTIC

DEPARTMENT OF THE ARMY, SOUTH ATLANTIC DIVISION LABORATORY
CORPS OF ENGINEERS, 611 SOUTH COBB DRIVE, MARIETTA, GA 30061

WORK ORDER NO. 0520
Re. No. SACEC-77-28



Sample No	Elev or Depth	Visual Classification	Nat w %	LL	PL	PI
--	--	Dk.gray clayey inorg.silt, high LL (MH) w/a trace of organic fines & shell frag. SpG = 2.62	118.8	--	--	--

GRADATION CURVES

Proje CHARLESTON DISTRICT, Village Creek
Lab. No. 3S-392*
Area
Boring No VC-2
Date 1 April 1977

ENG FORM 2087

*Elutriate Test reported on SAD Form 158R.
*Chemical Analysis of Sediment reported on SAD Form 158R.

END

FILMED

5-85

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